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Conversion of the Organic Matter of Domanic Shale and Permian Bituminous Rocks in Hydrothermal Catalytic Processes

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Abstract

© 2017 American Chemical Society. Comparative studies of hydrothermal transformation of organic matter samples of bituminous rocks from Domanic and Permian deposits of the Tatarstan Republic (Russian Federation) have been carried out. The experiments have been taken at a temperature of 300 °C in a vapor-gas carbon dioxide environment, with a content of 30% water in the reactionary system and an initial pressure of carbon dioxide of 2 MPa. It is shown that the distinguishing features of the organic matter of the analyzed species according to thermal analysis data are most prominent in the loss of its mass at various temperature intervals. Also, changes take place in group and structural composition and hydrocarbon composition, which have an impact on the composition of the initial products of experiments. Hydrothermal effects on the Domanic rock sample result in the destruction of structural polymer fragments of kerogen. It results in an increase in the contents of asphaltenes and their modified structures in the form of carben-carboids, insoluble in solvents characteristic of asphaltenes, thus reducing the relative content of saturated hydrocarbons in the products of the experiment. Under similar hydrothermal conditions, changes in the physical composition of the Permian rock are less significant. For the investigation of activation processes of the transformation of organic matter of the Permian rock, an experiment was conducted using catalysts. As catalysts, a composition of oil-soluble iron(II), cobalt(II), and copper(II) carboxylates with an additive of propanol was used. The use of the catalyst has increased the output of light fractions and reduced the content of resins and asphaltenes as part of Permian rock.

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